EVERETT PUBLIC SCHOOLS
7TH GRADE SCIENCE

Course: Pre-Engineering Technologies in Science (Grade 7 Science)		**Total Framework Hours:** 90
CIP Code: 140102	☒**Exploratory** ☐**Preparatory**	**Date Last Modified:** 03.2022
Career Cluster: STEM		**Cluster Pathway:** Engineering and Technology

COMPONENTS AND ASSESSMENTS

Performance Assessments:
Through their investigations, students

- analyze data to determine patterns in the relationship between the total amount of food they can heat and the amount of energy that is transferred from the chemical reaction to the food system.
- undertake a design project to construct and test a solution that meets specific design criteria and constraints, including the transfer of energy.
- respectfully provide and receive critiques about design solutions with respect to how they meet criteria and constraints and consider patterns across multiple designs to determine which design characteristics cause more effective outcomes in performance; and
- optimize performance of a design that transfers energy through a system by prioritizing criteria, making trade-offs, testing, revising, and re-testing.

Leadership Alignment:
Leadership activities are embedded within the curriculum and instruction. Students leverage communication and collaboration to think critically and solve problems, welcoming and utilizing ideas from each member of the learning community.
Students have opportunities to use, build upon and critique other's ideas.
Students use evidence to support ideas, ask for evidence from others, and suggest ways to get additional evidence.
Students have several opportunities to give and get feedback.
Students engage in science and engineering practices in meaningful ways in order to make progress on their questions.
Students' ideas and questions determine what evidence to collect.
Students seek and use evidence to figure something out as they build and revise their explanations, models and arguments.
The class community values the diversity of resources students bring to science class, including language, gestures, metaphors, and various modes of expression.
Norms are established and revisited to support equitable sensemaking.

Competitive Events:
Technology Student Association – Mechanical Engineering

Standards and Competencies

Unit: How can we use chemical reactions to design a solution to a problem? (7.2)

Industry Standards and/or Competencies	**Total Learning Hours for Unit:** 30

Standards for Technological Literacy
Students will develop an understanding of Design. This includes knowing about:

- the attributes of design.
- engineering design.

- the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Students will develop Abilities for the Technological World. This includes becoming able to:

- apply the design process.

Aligned Washington State Learning Standards	
English Language Arts	CCSS.ELA-LITERACY.W.7.1 Write arguments to support claims with clear reasons and relevant evidence. CCSS.ELA-LITERACY.W.7.1.A Introduce claim(s), acknowledge alternate or opposing claims, and organize the reasons and evidence logically. CCSS.ELA-LITERACY.W.7.1.B Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text. CCSS.ELA-LITERACY.W.7.1.C Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), reasons, and evidence. CCSS.ELA-LITERACY.SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly. CCSS.ELA-LITERACY.SL.7.1.A Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. CCSS.ELA-LITERACY.SL.7.1.B Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed. CCSS.ELA-LITERACY.SL.7.1.C Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed. CCSS.ELA-LITERACY.SL.7.1.D Acknowledge new information expressed by others and, when warranted, modify their own views. CCSS.ELA-LITERACY.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. CCSS.ELA-LITERACY.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
Mathematics	CCSS.MATH.CONTENT.6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. CCSS.MATH.CONTENT.6.RP.A.3.C Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. CCSS.MATH.CONTENT.6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double-number line diagrams, or equations. CCSS.MATH.CONTENT.6.RP.A.3.A Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
Science	MS-PS1-6: Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best

	characteristics of each that can be combined into a new solution to better meet the criteria for success. MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Students will

- plan and carry out simulated computer model investigations to examine what orangutans need to support healthy populations,
- engage in mathematical reasoning and computational thinking to determine the area of forest required by orangutans and how resource availability impacts orangutan populations,
- model competition for available resources within and between populations, and model other interactions (e.g., predation, mutually beneficial interactions, etc.) between populations,
- use models to predict and test how various disruptions would impact more or less biodiverse systems,
- construct arguments that more biodiverse plant communities support other living things, particularly when there is a disruption, and
- obtain information about alternative farming approaches and ecosystem services in comparison to monocrop farming and apply these ideas to the design of an oil palm farm system that supports both orangutans and farmers.

Leadership Alignment:

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The class community values the diversity of resources students bring to science class, including language, gestures, metaphors, and various modes of expression.
Norms are established and revisited to support equitable sensemaking.

Competitive Events:

Technology Student Association – Challenging Technology Issues, Problem Solving

Standards and Competencies

Unit: How does changing an ecosystem affect what lives there? (7.5)

Industry Standards and/or Competencies	**Total Learning Hours for Unit:** 30

Standards for Technological Literacy
Students will develop an understanding of Design. This includes knowing about:

- the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Students will develop Abilities for the Technological World. This includes becoming able to:

- apply the design process.
- assess the impact of products and systems.

Aligned Washington State Learning Standards

English Language Arts	CCSS.ELA-LITERACY.W.7.1 Write arguments to support claims with clear reasons and relevant evidence. CCSS.ELA-LITERACY.W.7.1.A Introduce claim(s), acknowledge alternate or opposing claims, and organize the reasons and evidence logically. CCSS.ELA-LITERACY.W.7.1.B

	Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text. CCSS.ELA-LITERACY.W.7.1.C Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), reasons, and evidence. CCSS.ELA-LITERACY.SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly. CCSS.ELA-LITERACY.SL.7.1.A Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. CCSS.ELA-LITERACY.SL.7.1.B Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed. CCSS.ELA-LITERACY.SL.7.1.C Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed. CCSS.ELA-LITERACY.SL.7.1.D Acknowledge new information expressed by others and, when warranted, modify their own views. CCSS.ELA-LITERACY.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. CCSS.ELA-LITERACY.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
Environment & Sustainability	Standard 1: Ecological, Social, and Economic Systems Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels. Standard 2: The Natural and Built Environment Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments. Standard 3: Sustainability and Civic Responsibility Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability.
Mathematics	CCSS.Math.Content.6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. CCSS.Math.Content.6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. CCSS.Math.Content.6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. CCSS.Math.Content.6.RP.A.3.c Find a percent of a quantity as a rate per 100. CCSS.Math.Content.6.RP.A.3.d Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. CCSS.Math.Content.6.NS.B.2 Fluently divide multi-digit numbers using the standard algorithm. CCSS.Math.Content.6.NS.B.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. CCSS.Math.Content.6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. CCSS.Math.Content.6.SP.A.1 Recognize a statistical question as one that anticipates variability in the data related to the question

	and accounts for it in the answers. CCSS.Math.Content.6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution, which can be described by its center, spread, and overall shape. CCSS.Math.Content.6.SP.B.5.c Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern, with reference to the context in which the data were gathered.
Science	MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services. MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Through these investigations, students will

- analyze and interpret data that indicate long-term climate variables (temperature and precipitation) are changing in communities,
- develop and use models to explain how changing variables in Earth's water and carbon systems are impacting human communities that depend on those systems,
- construct an explanation for how increased temperatures can cause changes to a community's water resources,
- argue from evidence that rising temperatures result from an imbalance in Earth's carbon system,
- define the problem as an imbalance in Earth's carbon system due to greenhouse gas accumulation, with no easy solutions to quickly fix it,
- evaluate a variety of solutions based on how well they meet the criteria of reducing the carbon imbalance given the many societal constraints students identified, and
- communicate about a community resilience designed to account for stakeholders' needs while also correcting carbon imbalances and adapting to current changes experienced in the community.

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Norms are established and revisited to support equitable sensemaking.
Competitive Events:
Technology Student Association – Challenging Technology Issues, Off the Grid

Standards and Competencies

Unit: How do changes in the Earth's system impact our communities and what can we do about it? (7.6)

Industry Standards and/or Competencies	**Total Learning Hours for Unit:** 30

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Environment & Sustainability	Standard 2: The Natural and Built Environment Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.

Mathematics	CCSS.Math.Content.6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. CCSS.Math.Content.6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. CCSS.Math.Content.6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. CCSS.Math.Content.6.NS.B.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. CCSS.Math.Content.6.SP.B.5.c Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern, with reference to the context in which the data were gathered.
Science	MS-ESS3-1: Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

21st Century Skills		
Check those that students will demonstrate in this course:		
LEARNING & INNOVATION **Creativity and Innovation** ☒Think Creatively ☒Work Creatively with Others ☒Implement Innovations **Critical Thinking and Problem Solving** ☒Reason Effectively ☒**U**se Systems Thinking ☒Make Judgments and Decisions ☒Solve Problems **Communication and Collaboration** ☒Communicate Clearly ☒Collaborate with Others	**INFORMATION, MEDIA & TECHNOLOGY SKILLS** **Information Literacy** ☒Access and /evaluate Information ☒Use and Manage Information **Media Literacy** ☒Analyze Media ☒Create Media Products **Information, Communications and Technology (ICT Literacy)** ☒Apply Technology Effectively	**LIFE & CAREER SKILLS** **Flexibility and Adaptability** ☒Adapt to Change ☒Be Flexible **Initiative and Self-Direction** ☒Manage Goals and Time ☒Work Independently ☒Be Self-Directed Learners **Social and Cross-Cultural** ☒Interact Effectively with Others ☒Work Effectively in Diverse Teams **Productivity and Accountability** ☒Manage Projects ☒Produce Results **Leadership and Responsibility** ☒Guide and Lead Others ☒Be Responsible to Others